"On Boomerangs." By G. T. WALKER, M.A., B.Sc., Fellow of Trinity College, Cambridge. Communicated by Professor J. J. THOMSON, F.R.S. Received March 15,—Read April 8, 1897.

(Abstract.)

A typical returning boomerang resembles in general outline a symmetrical arc of a hyperbola, and is about 80 cm. in length measured along the curve. At the centre, where the dimensions of the cross section are greatest, the width is about 7 cm., and the thickness 1 cm.

Of the two faces, one is distinctly more rounded than the other; in addition the arms are twisted through about 4°, in the same manner as the blades of a right-handed screw propeller.

Such an implement, if thrown with its plane vertical, will describe a circular path of 40 or 50 metres in diameter, rising to a height of from 7 to 12 metres, and falling to the ground with its plane of rotation horizontal at a point somewhere near the thrower's feet.

The flight may be regarded as a case of steady motion, of which the circumstances gradually vary. In the more complicated, as well as the simpler, paths, observation makes it clear that everything depends on the changes in direction and inclination of the plane of the boomerang, and that the character of these changes is always the same; if they can be explained theoretically, the peculiarities of the motion may be accounted for.

Since the effects of the different forces at work are conflicting, it is necessary to adopt quantitative methods, even if the degree of accuracy attainable is not high; accordingly ratios comparable with a tenth are treated as small, and their squares neglected.

If we regard the boomerang as a thin, slightly distorted lamin, and integrate over it the forces indicated in S. P. Langley's paper on "Experiments in Aerodynamics,"* we can obtain equations of motion. From these, treating the motion as steady (to the first approximation), we may deduce the values of the angular velocities on which the direction of the axis of rotation depends. Five cases are worked out numerically, and the various effects of the "rounding" and "twisting" agree in character with the experimental facts; the discrepancies in actual magnitude are not larger than might, from the nature of the case, have been anticipated.

The theoretical results may be further tested by applying them to determine the conditions favourable to the production of other flights in which, after the first circle, a loop is described, either in

* 'Smithsonian Contributions to Knowledge,' 1891.

front of or behind the thrower; in each of these cases success has been attained. An explanation is also afforded of the returning of a boomerang without "twist," made by Mr. O. Eckenstein, and of the wonderfully long, straight trajectories of some of the native non-returning implements.

" Condensation of Water Vapour in the presence of Dust-free Air and other Gases." By C. T. R. WILSON, B.Sc. (Vict.), M.A. (Cantab.), of Sidney Sussex College, Clerk-Maxwell Student in the University of Cambridge. Communicated by Professor J. J. THOMSON, F.R.S. Received March 15, Read April 8, 1897.

(Abstract.)

In a note read before the Cambridge Philosophical Society (May 13, 1895) I stated, as the result of some preliminary experiments, that when air, originally saturated with aqueous vapour, undergoes sudden expansion exceeding a certain critical amount, condensation takes place in the form of drops throughout the moist air, even in the absence of all foreign nuclei.

The present paper contains an account of the measurements which were afterwards made of this critical expansion in air and other gases, as well as of further phenomena which have since been observed in connection with the condensation of aqueous vapour from the supersaturated state.

Two different forms of expansion apparatus have been used. Both were designed to enable a given sample of the saturated gas to be suddenly expanded as often as might be desired without any risk of foreign nuclei entering. All such nuclei originally present were removed by repeatedly forming a cloud by expansion and allowing it to settle, till expansions of moderate amount ceased to cause any visible condensation. In both forms of apparatus a definite expansion of any desired amount could be produced. They were designed to give an exceedingly rapid expansion, the rate at which the volume was increasing being greatest, too, just before the expansion was completed, when the temperature was lowest and the influx of heat from the walls most rapid ; so that, as indeed appears from the constancy of the results obtained, the theoretical lowering of temperature must have been very nearly reached.

The two machines, in spite of the fact that the volume of the air in the first was twenty times as great as that contained in the second, gave identical results. The larger machine was only used in the experiments on air.